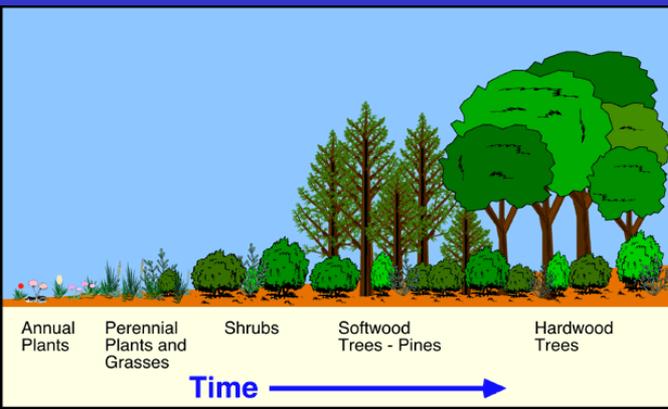
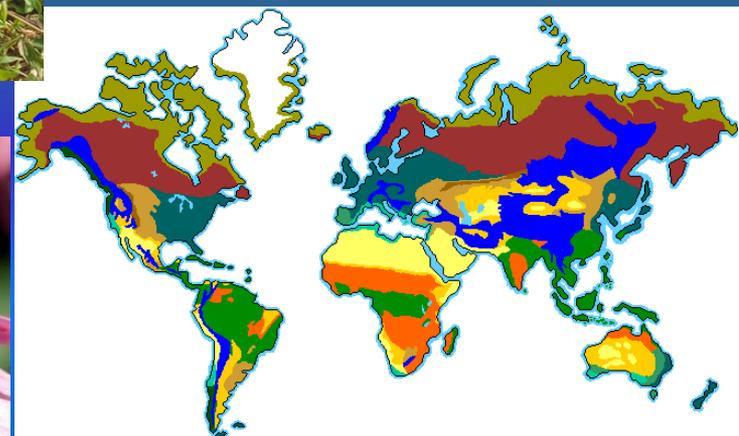
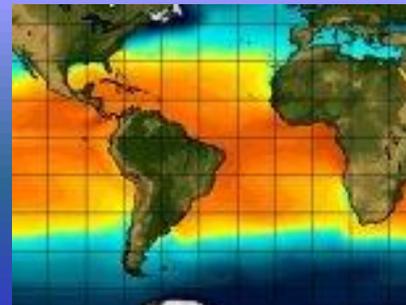


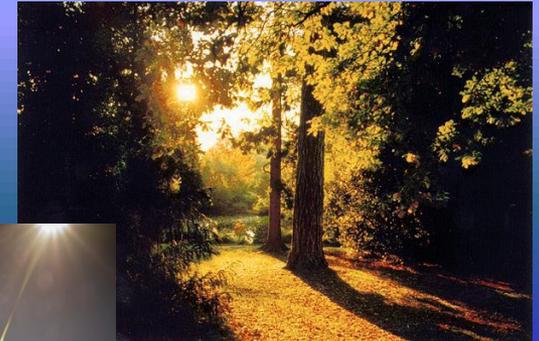
Chapter 4: Ecosystems & Communities



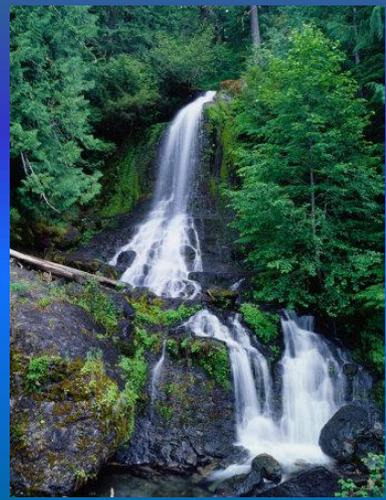
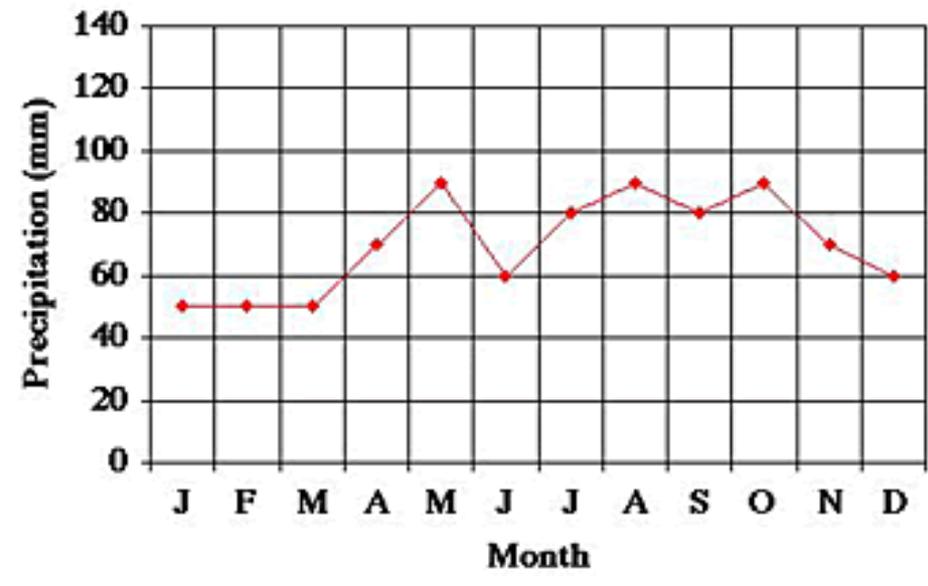
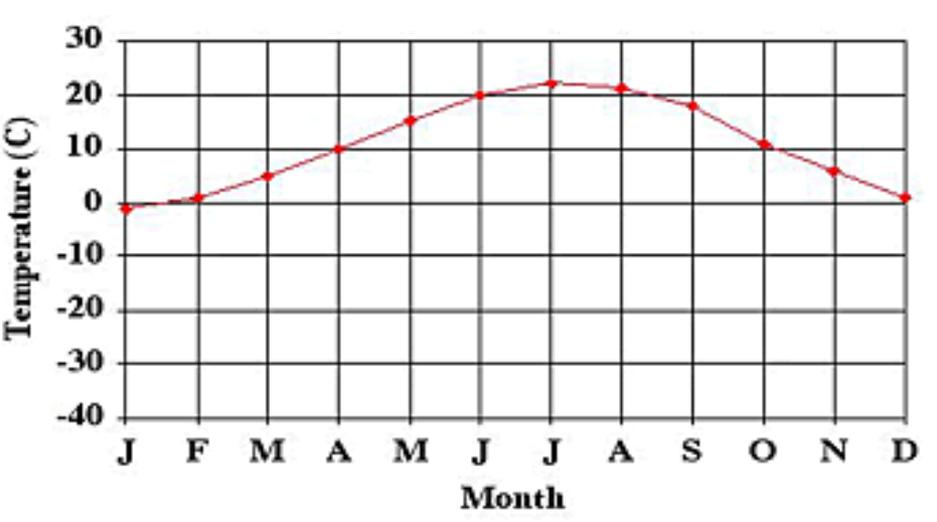
- Tropical Rainforest
- Deciduous
- Chaparral
- Grasslands
- Tundra
- Savanna
- Desert
- Coniferous Forest (Taiga)
- Alpine

Section 4.1 – The Role of Climate

- In Earth's atmosphere, temperature, precipitation, and other environmental factors combine to produce weather and climate.
- Weather is the day-to-day condition of Earth's atmosphere at a particular time and place.
- The weather may be clear and sunny one day and cold and rainy the next.

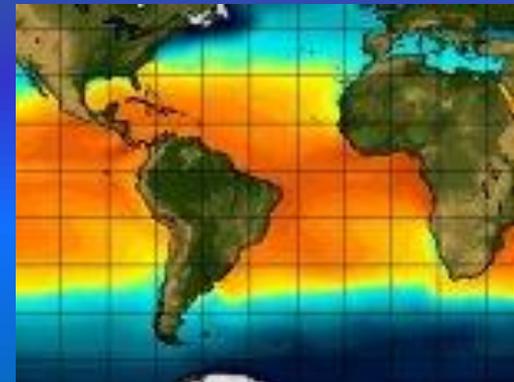
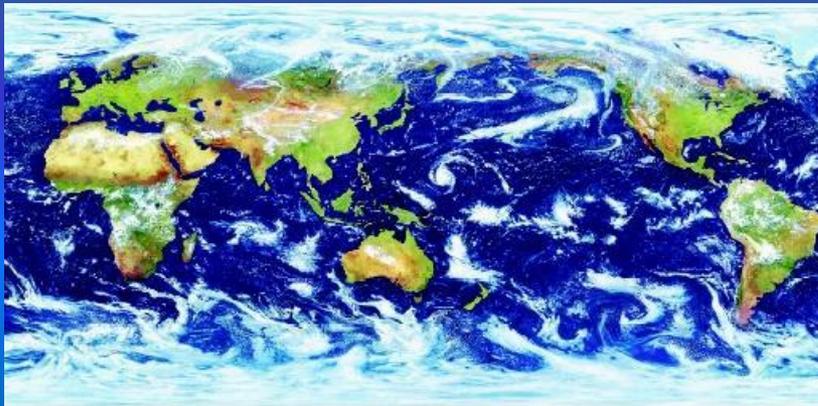


• Climate is the average, year-to-year conditions of temperature and precipitation in a particular region.



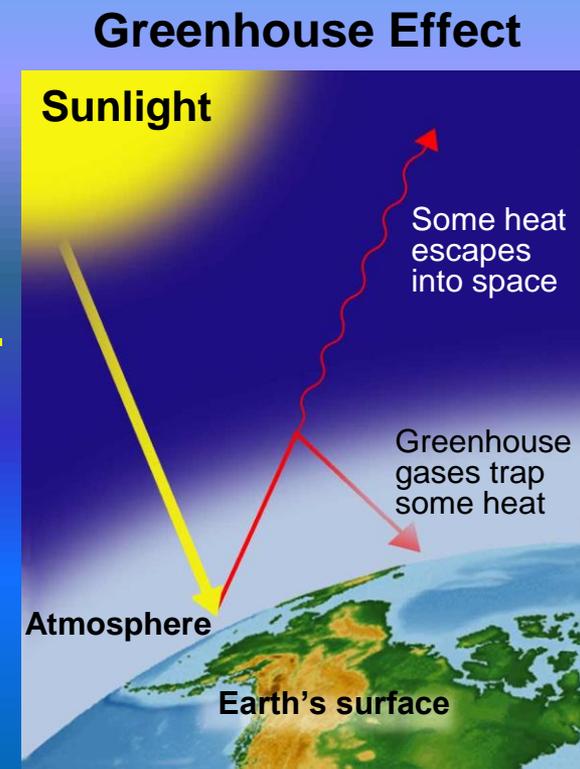
Factors that Determine Climate

- Trapping of heat by the atmosphere
- The latitude
- Transportation of heat by winds and ocean currents
- The amount of precipitation
- The shape and elevation of the land
- Presence of certain gases in the atmosphere

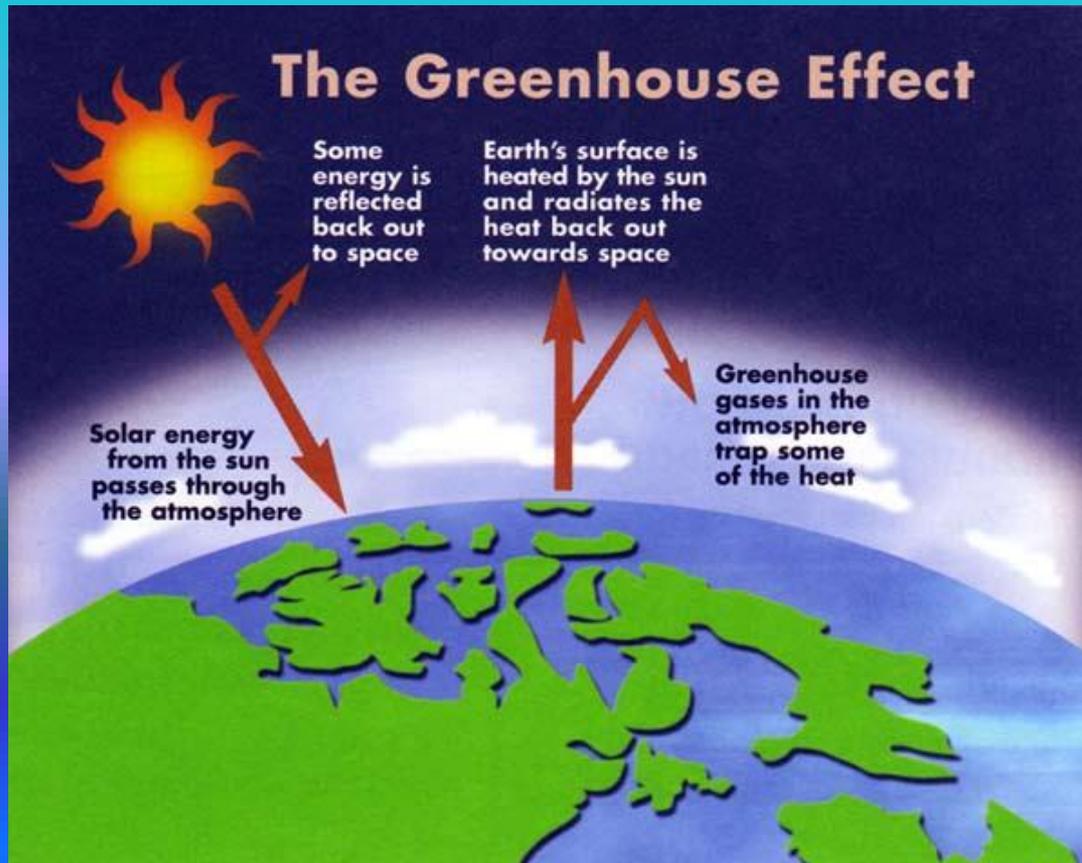


The Greenhouse Effect

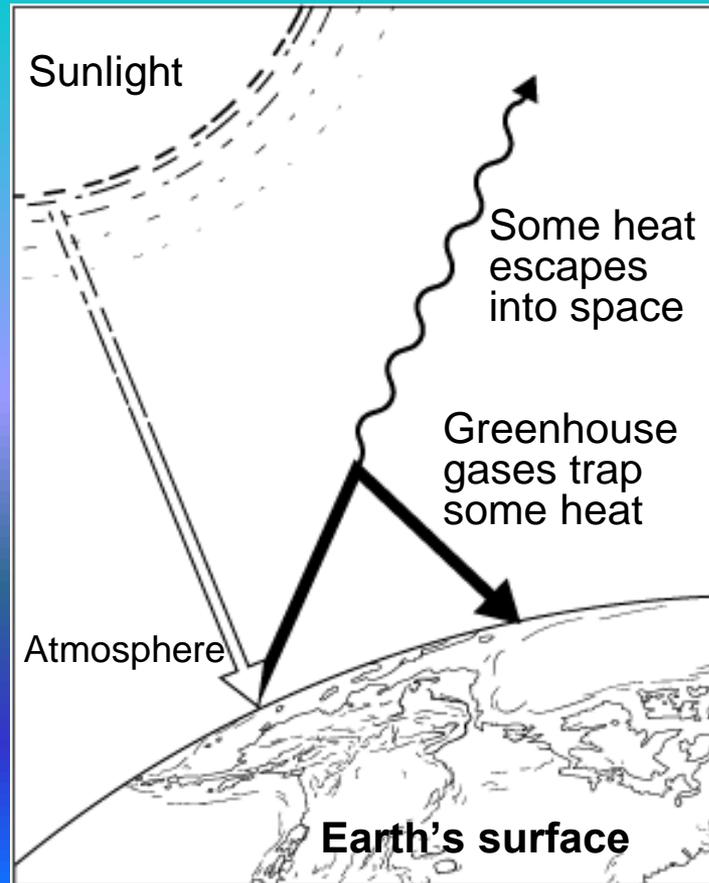
- In addition to being the main source of energy for life on Earth, sunlight drives both weather and climate.
- Temperatures on Earth remain within a suitable range for life because the biosphere has a natural insulating blanket: the atmosphere.
- Greenhouse gases trap some of the sun's heat energy and help maintain Earth's temperature range.
- Earth's greenhouse gases include: carbon dioxide, methane, and water vapor.



The Greenhouse Effect

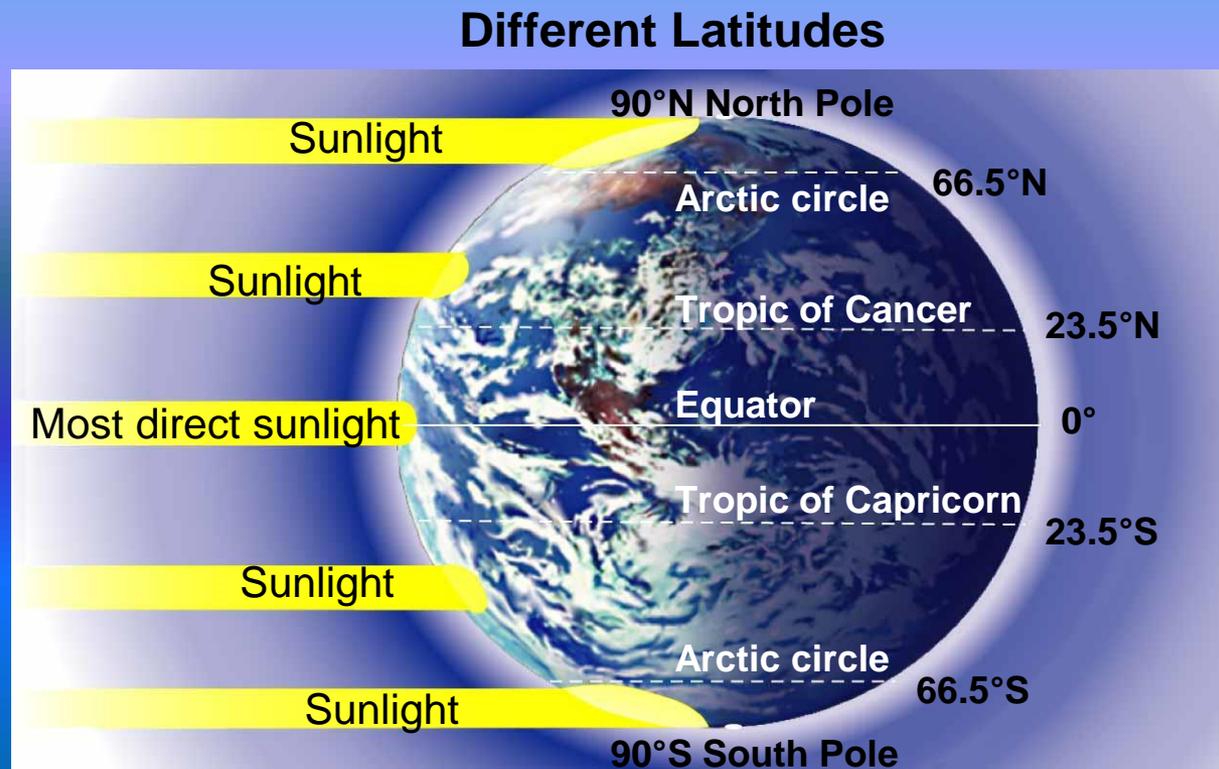


The Greenhouse Effect

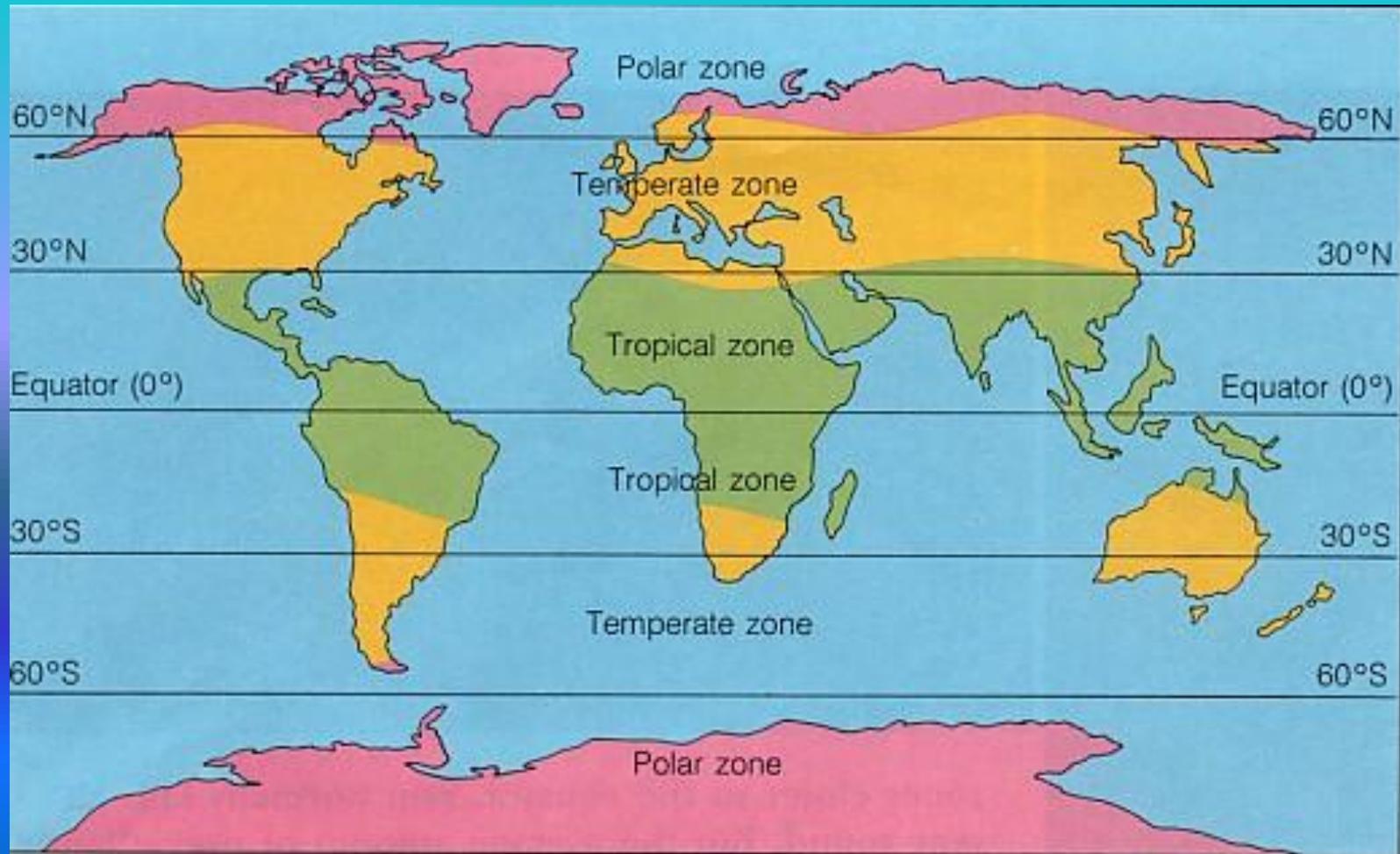


The Effect of Latitude on Climate

- Due to differences in latitude and the angle of heating, Earth has three main climate zones: polar, temperate, and tropical.

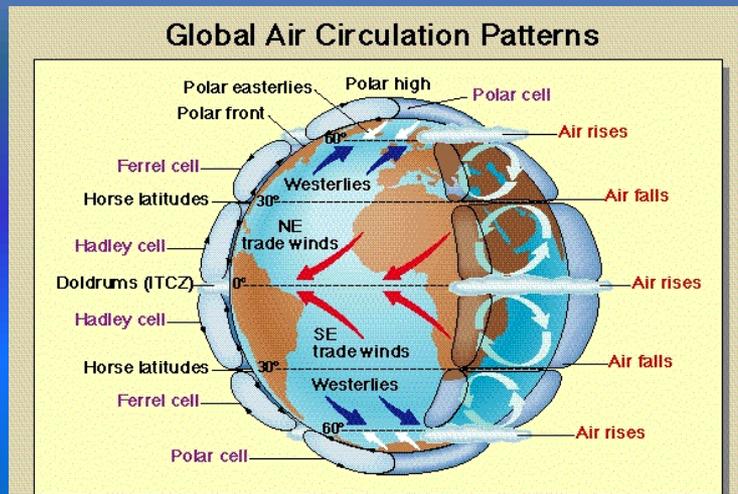
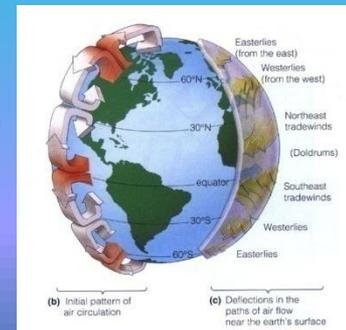
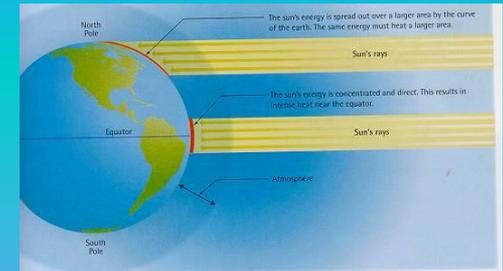


Earth's Climate Zones



Heat Transport in the Biosphere

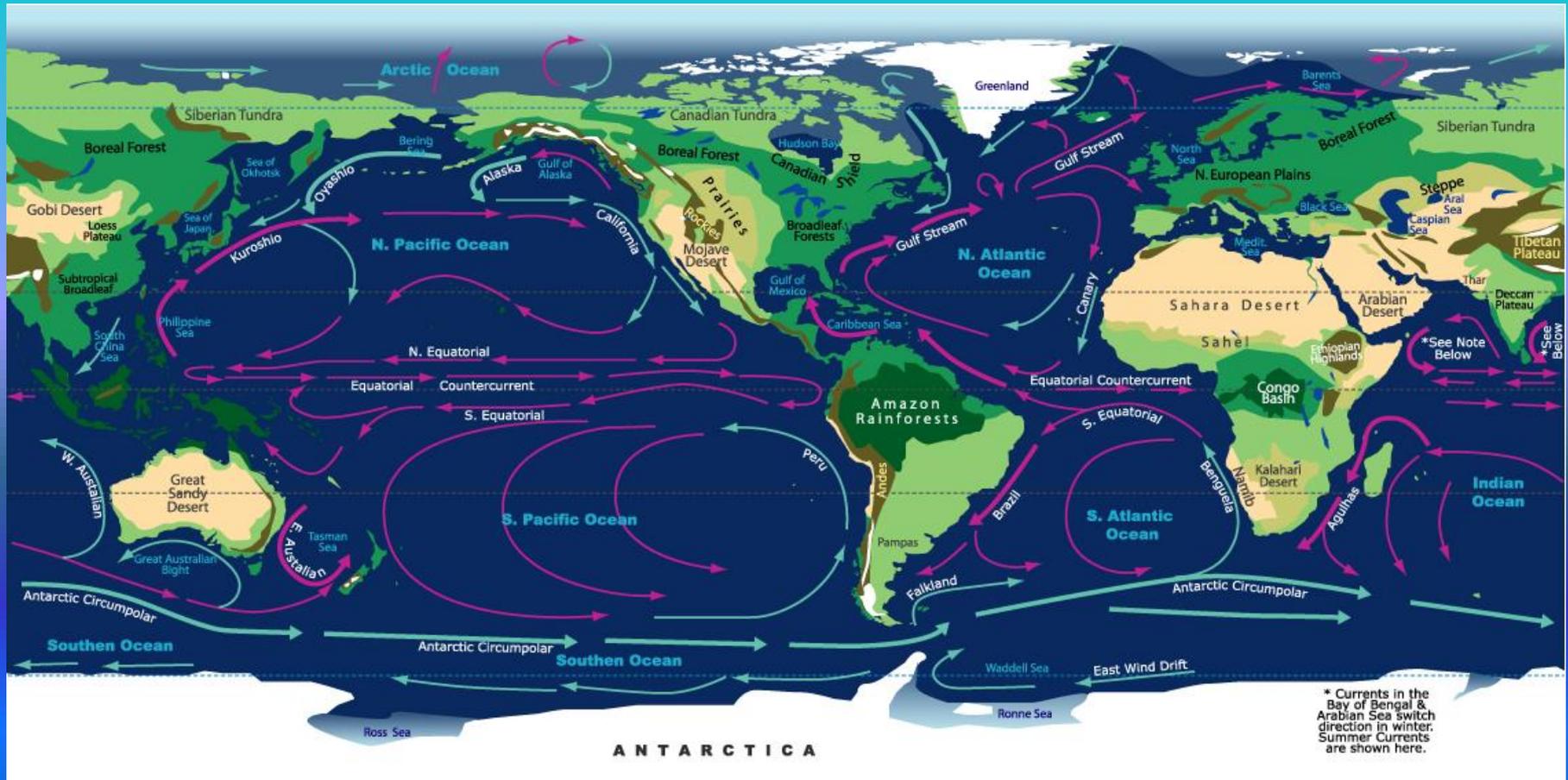
- The unequal heating of the Earth's surface drives winds and ocean currents which move heat through the biosphere.
- Convection currents are created as warm air or water rises (upwelling) and cold air or water sinks.
- This movement of water and air creates the prevailing wind and water currents.



Global air circulation as described in the three-cell circular model. As in simpler circulation models, air rises at the equator and falls at the poles. But instead of one great circuit in each hemisphere from equator to pole, there are three. Note the influence of the Coriolis effect on wind direction.

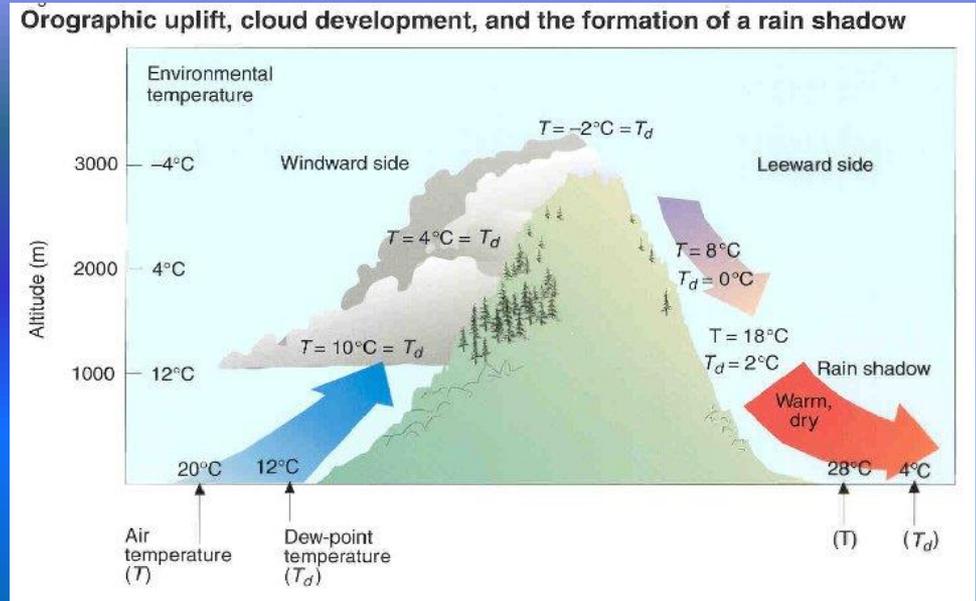
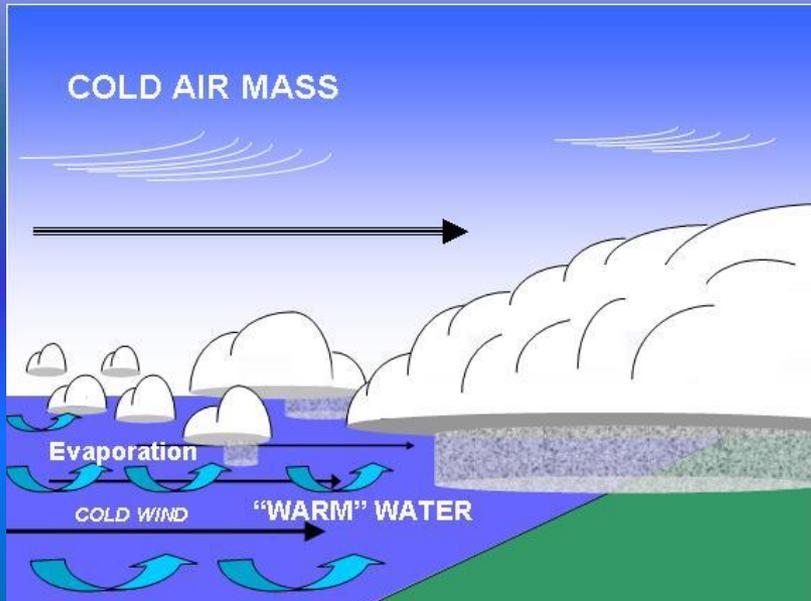
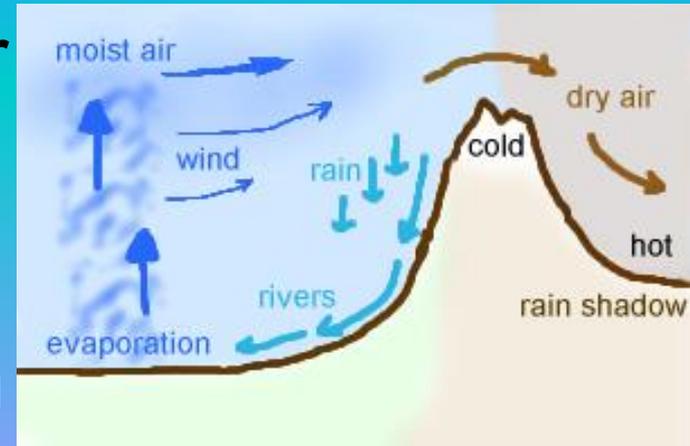


Earth's Ocean Currents



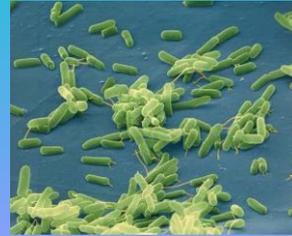
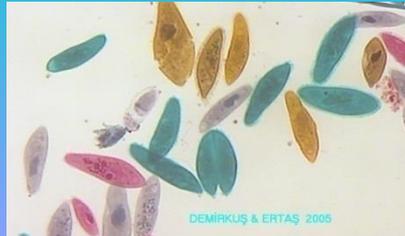
Effect of Water & Landmasses

- Water can cool or heat the air above affecting weather on nearby landmasses.
- Geographical boundaries can also affect weather and climate. ex: mountains



Section 4.2 – What Shapes an Ecosystem?

- Biotic factors – the biological (living) influences on organisms within an ecosystem.

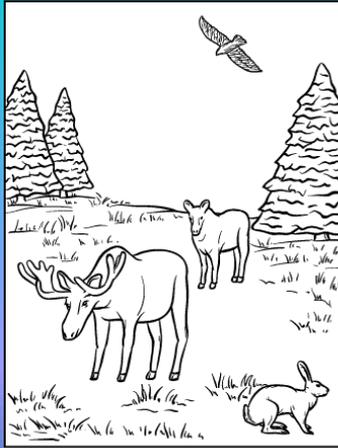


- Abiotic factors – the physical, or nonliving factors that shape ecosystems.

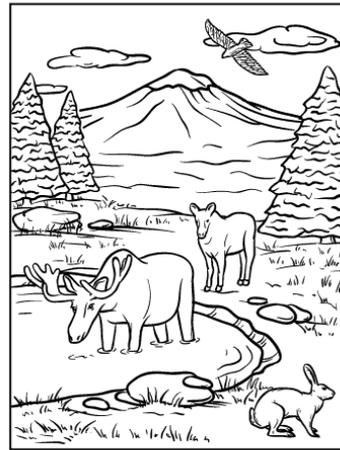


- Together, biotic and abiotic factors determine the survival and growth of an organism and the productivity of the ecosystem in which the organism lives.

Abiotic and Biotic Factors



Biotic Factors



ECOSYSTEM

Abiotic Factors

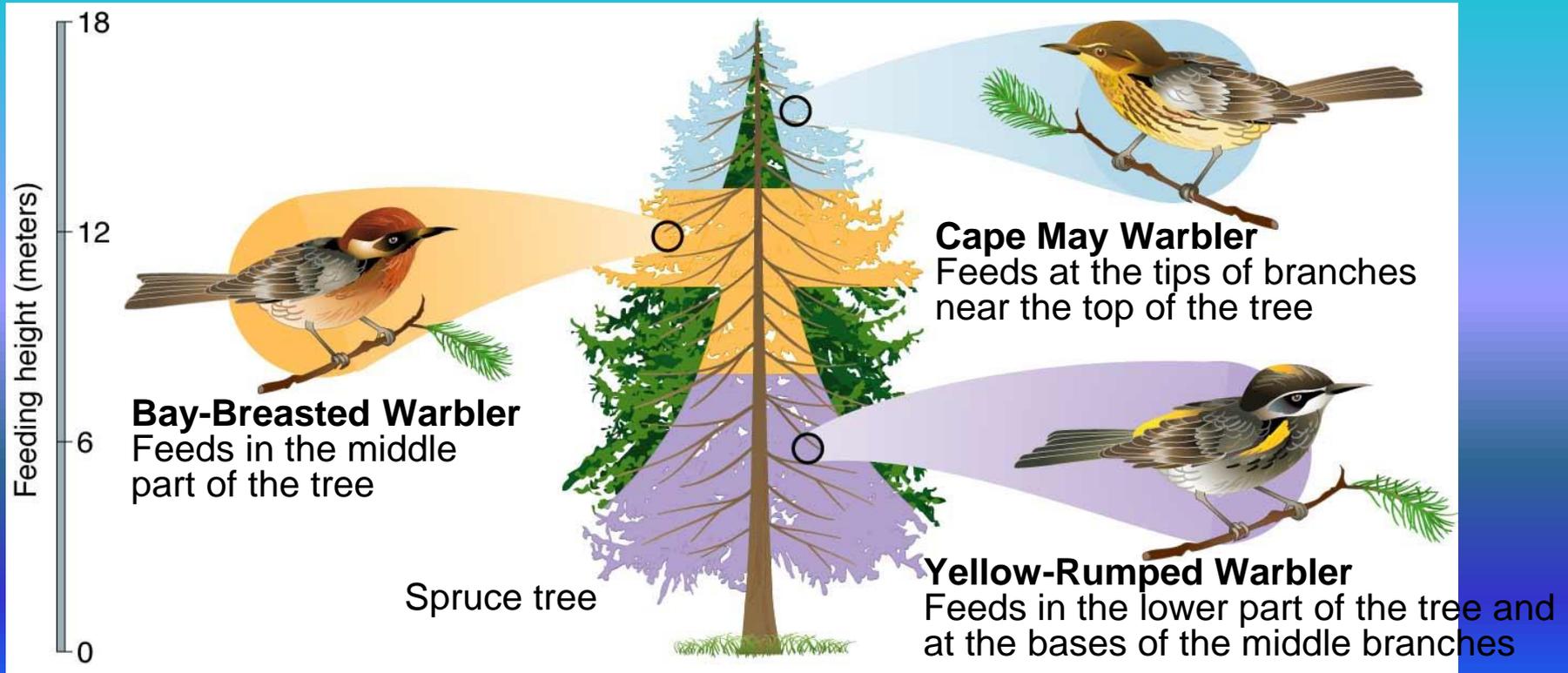


- The area where an organism lives is called its habitat.
- A habitat includes both biotic and abiotic factors.



- If an organism's habitat is its address, its niche is its occupation.
- A niche is the full range of physical and biological conditions in which an organism lives and the way in which the organism uses those conditions.
- An organism's niche includes the type of food it eats, how it obtains food, its place in the food web, the temperature it needs to survive, where it lives, how and when it reproduces, etc.
- A niche is basically an organism's role in the ecosystem.
- The **competitive exclusion principle** states that no two species can share the same niche in the same habitat at the same time. If they would, competition would result death or displacement of one of the species.
- However, different species can occupy niches that are very similar.

Three Species of Warblers and Their Niches



Different Niches in the Galapagos



- Blue-footed, red-footed, and Nazca boobies exist in the Galapagos Islands.
- In order to co-exist, these birds must have different niches.
- They nest in different locations and hunt for food in different areas of the ocean.

Community Interactions

- When organisms live together in ecological communities, they interact constantly.
- These interactions help shape the ecosystem in which they live.
- Community interactions such as competition, predation, and various forms of symbiosis can powerfully affect an ecosystem.



Competition

- **Competition** occurs when organisms attempt to use an ecological resource in the same place at the same time.



- The term **resource** refers to any necessity of life. Ex: water, nutrients, light, food, space, mates, etc.

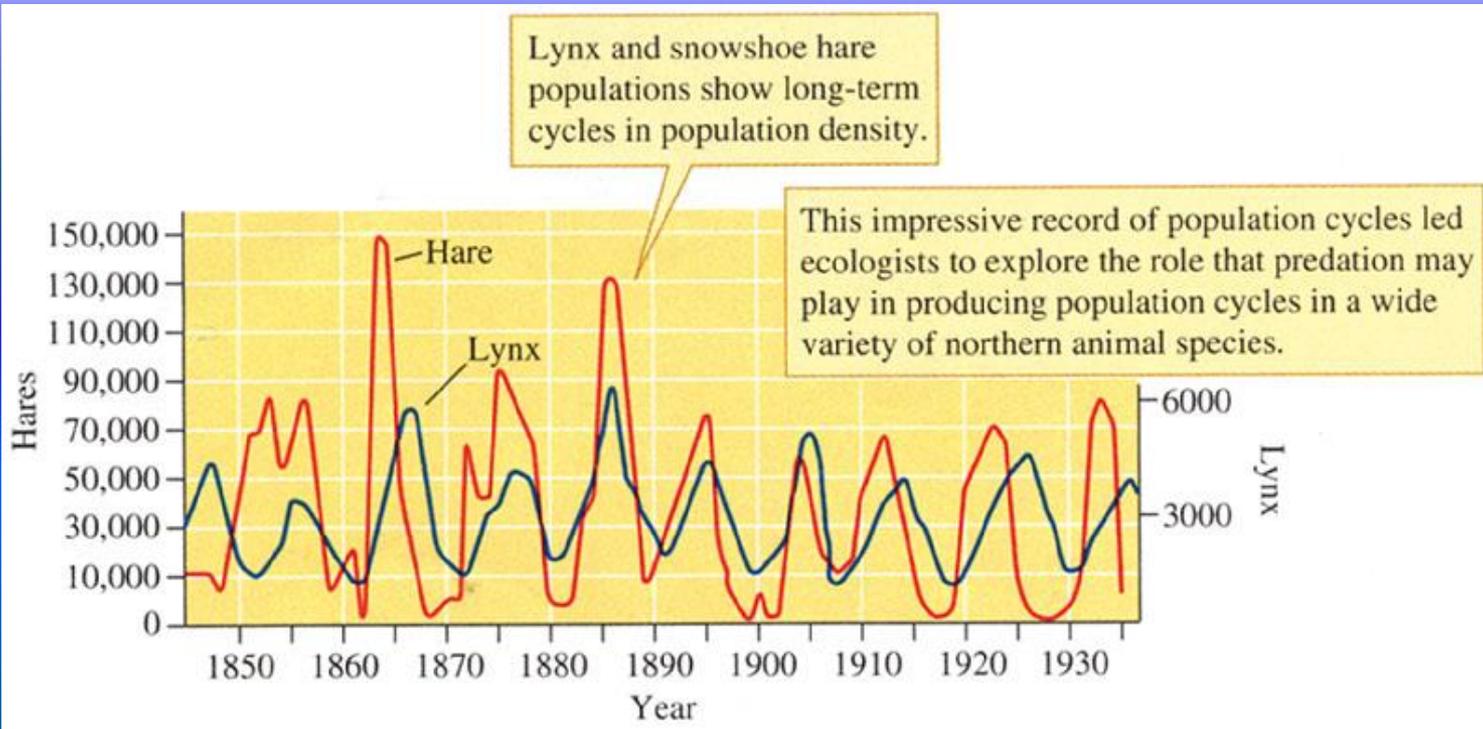
Predation

- An interaction in which one organism captures and feeds on another organism is called **predation**.



- The **predator** captures and feeds on the **prey**.

Lynx and Snowshoe Hare Predator-Prey Relationship



Symbiosis

- Any relationship in which two species live closely together is called **symbiosis**.
- Biologists recognize three types of symbiotic relationships in nature:

- Mutualism



- Commensalism

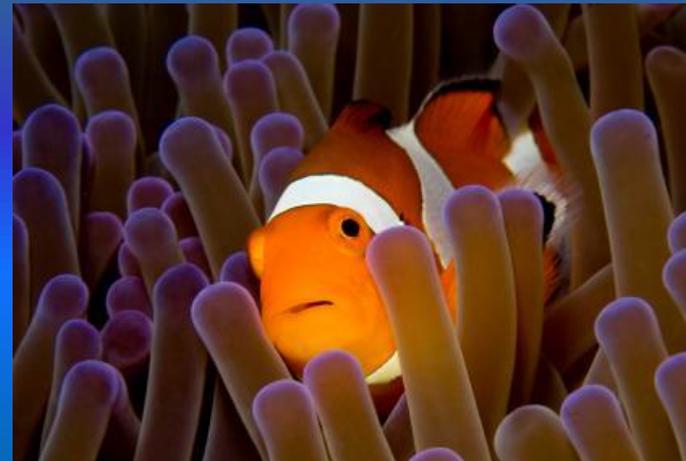


- Parasitism



Mutualism

- In a **mutualism**, both species benefit from the relationship.



Commensalism

- In **commensalism**, one member of the association benefits and the other is neither helped nor harmed.



Parasitism

- In **parasitism**, one organism lives on or inside another organism and benefits, while harming it.

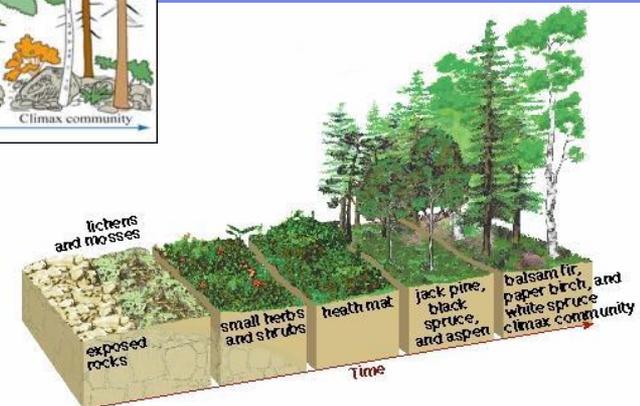
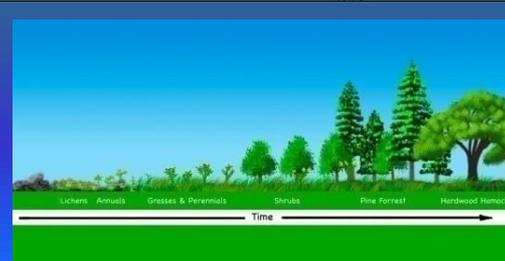
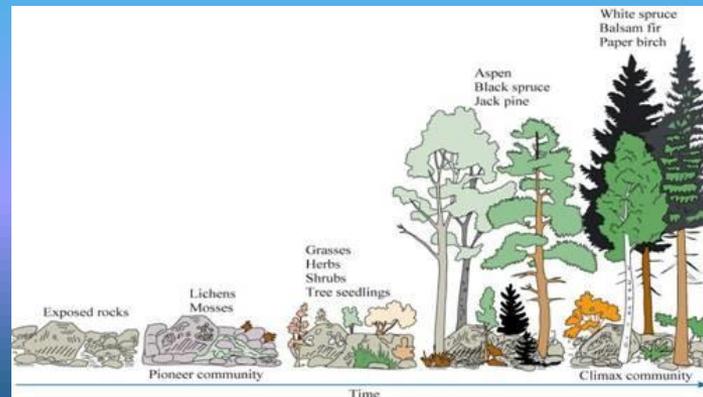


Ecological Succession

- Ecosystems are constantly changing in response to natural and human disturbances.
- As an ecosystem changes, older inhabitants gradually die out and new organisms move in, causing further changes in the community.
- The series of predictable changes that occur in a community over time is called **ecological succession**.
- The 2 main types of succession are primary succession and secondary succession.

Primary Succession

- **Primary Succession** – succession that occurs where there is no soil (after a volcanic eruption) The first organism to start primary succession is called a **pioneer species**.

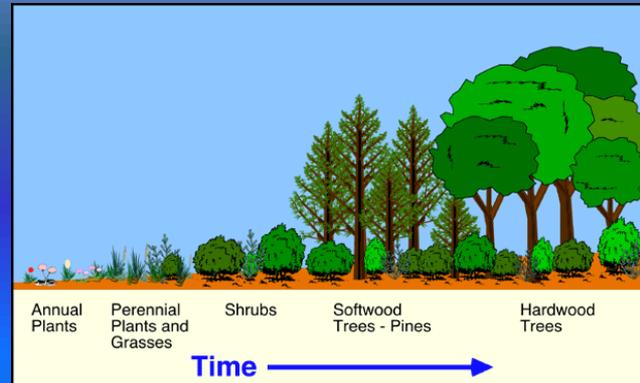
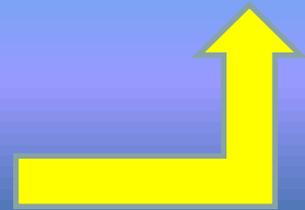


- Lichens are usually the pioneer species that break up rock and eventually form soil.



Secondary Succession

- **Secondary Succession** – occurs when soil is already present after a disturbance.
- Ex: after a farmer plows or after a forest fire



- The final and most stable stage of succession is called a **climax community**. (until another disturbance)

Succession in a Marine Ecosystem



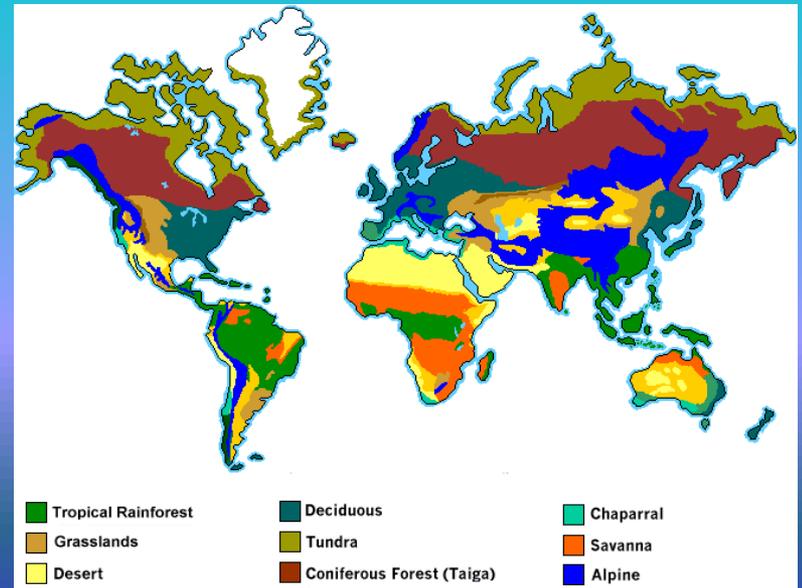
- First stage: Large whale dies and sinks attracting scavengers.
- Second stage: smaller decomposers take over and nutrients enter the soil for worms.
- Third stage: Bacteria break down the bones leading to bacteria eating organisms like mussels, snails, worms, crabs, and clams.

Section 4.3 - Biomes

- Ecologists group Earth's diverse environments into biomes.

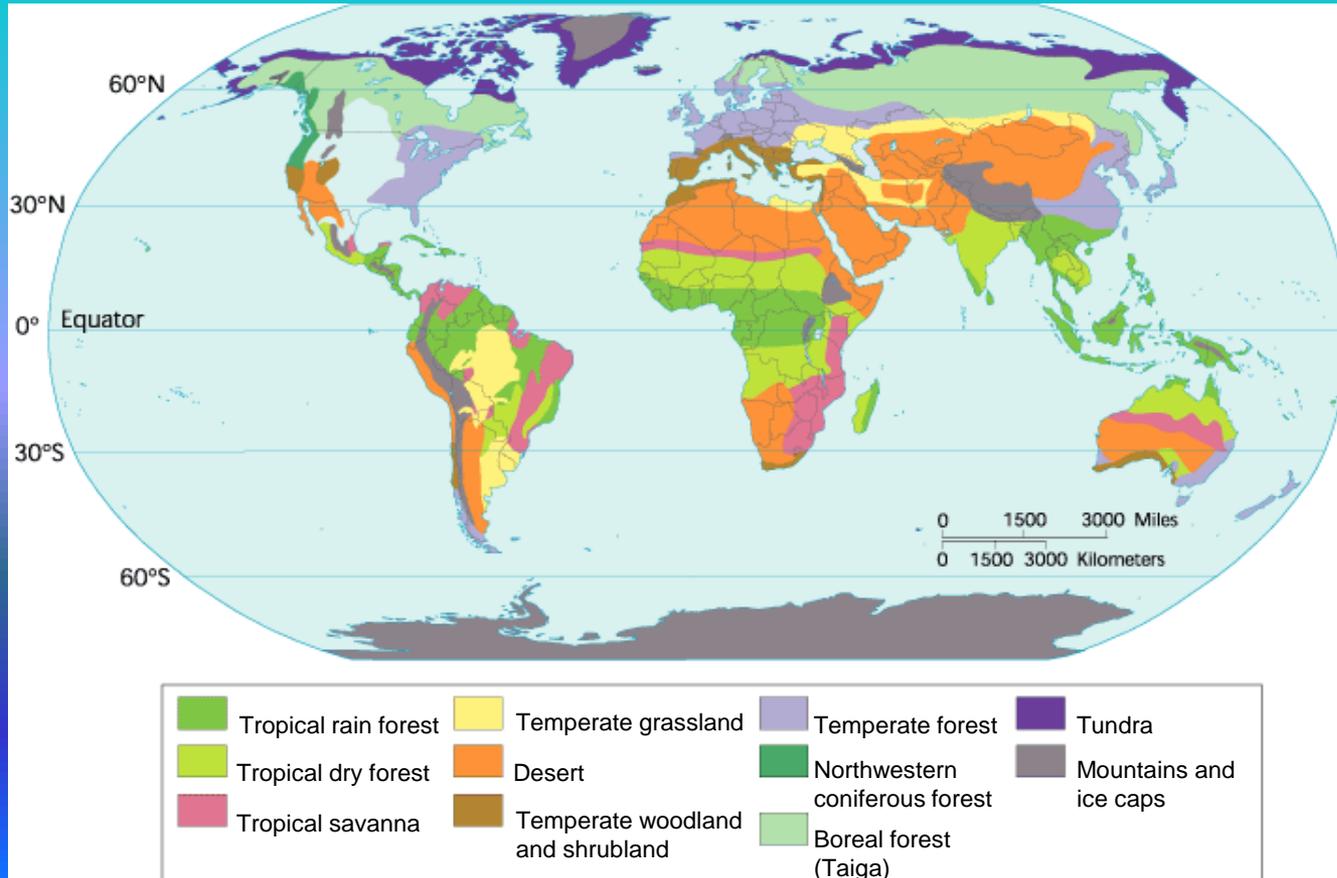
- A **biome** is a complex community that is characterized by climate, wildlife, and types of soil.

- There are ten major biomes with a gradual transition between the biomes.



- Plants and animals are adapted to live in specific biomes, but they have certain **tolerances** to survive and reproduce that differ from their optimal conditions.
- Even within a particular biome there are **microclimates** which are small areas that differs from surrounding climates

The World's Major Land Biomes

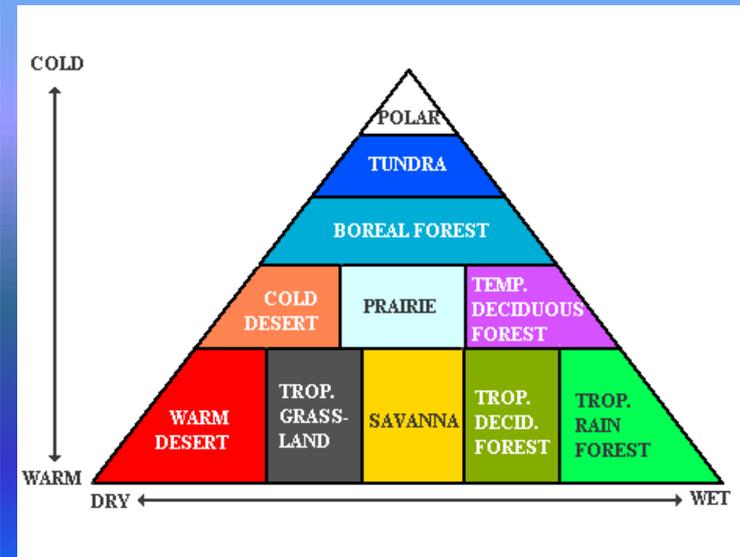
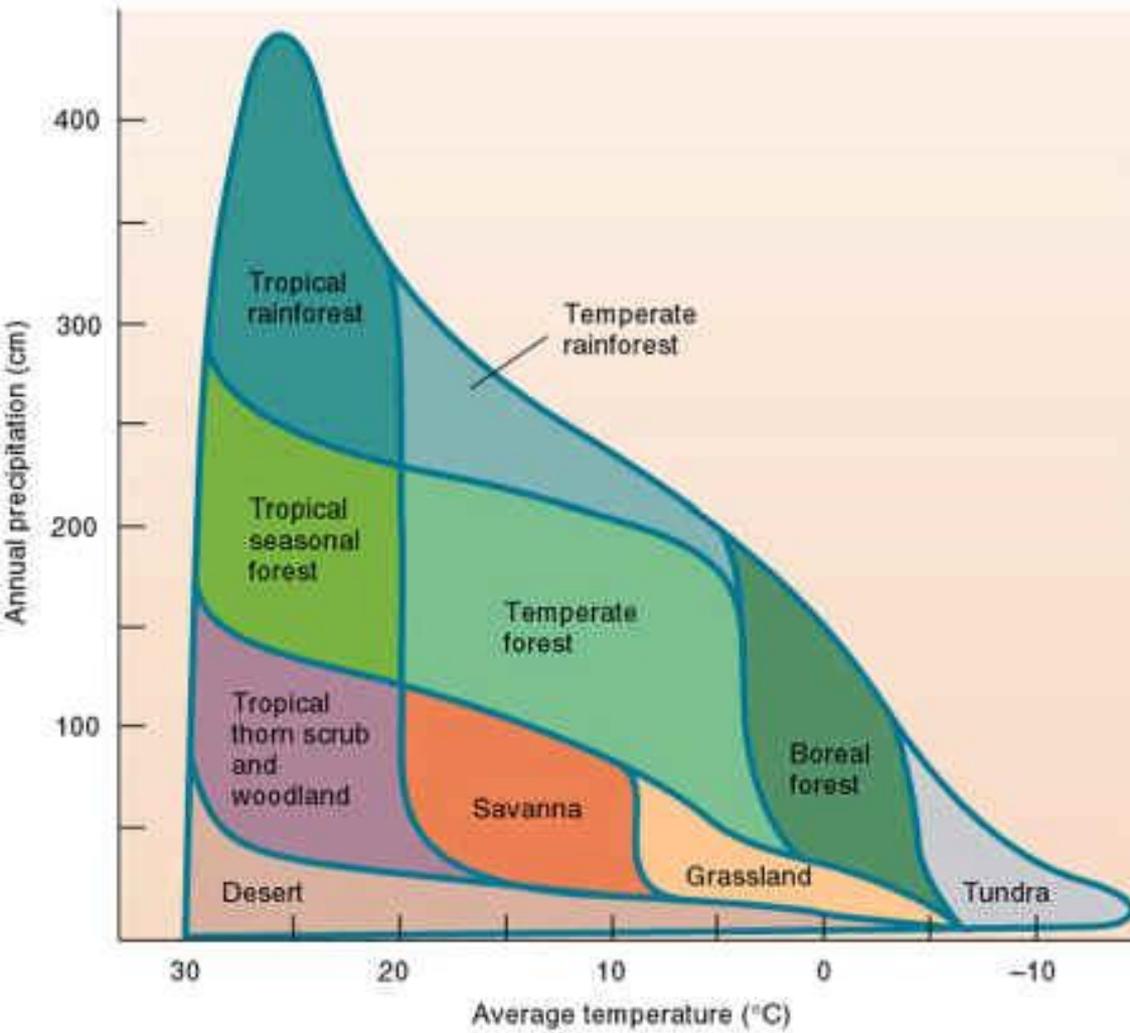


Ten Major Biomes

Biome	Precipitation	Temperature	Soil	Diversity	Trees	Grasses
Tropical Rain Forest	high	hot	poor	high	dense	sparse
Tropical Dry Forest	variable	mild	rich	moderate	medium	medium
Tropical Savanna	variable	mild	clay	moderate	sparse	dense
Desert	low	variable	poor	moderate	sparse	sparse
Temperate Grassland	moderate	summer hot	rich	moderate	absent	dense
Temperate woodland and Shrubland	summer low, winter moderate	summer hot	poor	low	medium	medium
Temperate Forest	moderate	summer moderate, winter cold	rich	high	dense	sparse
Northwestern Coniferous Forest	high	summer mild, winter cold	rocky, acidic	low	dense	sparse
Boreal Forest	moderate	summer mild, winter cool	poor, acidic	moderate	dense	sparse
Tundra	low	summer mild, winter cold	poor	low	absent	medium

Average Annual Temperature & Precipitation of Land Biomes

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Tropical Rain Forest

- **Tropical Rain Forest** – incredible genetic diversity – dense tree covering called a canopy – under the canopy is the understory – warm, wet, and nutrient poor soils



Tropical Dry Forest

- **Tropical Dry Forest** – less rainfall – forest is deciduous – rich soils subject to erosion



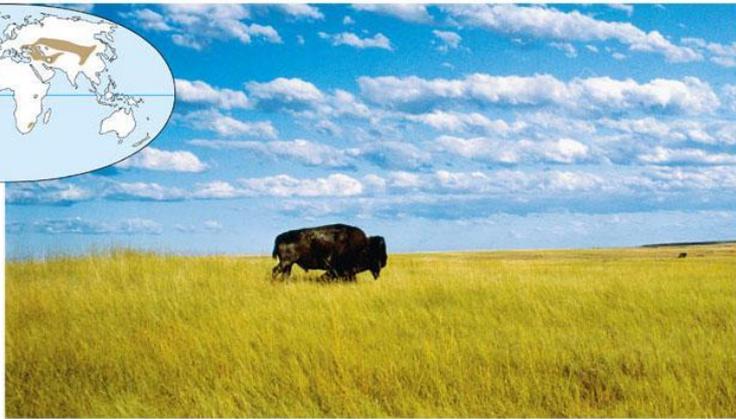
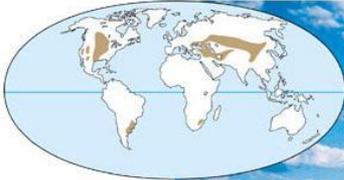
Tropical Savanna

- **Tropical Savanna** – even less rainfall – typically covered in grasses with few trees – frequent fires set by lightning



Temperate Grassland

- **Temperate Grassland** – grasses with very fertile soil – warm summers and cold winters



Desert

- **Desert** – less than 25 cm of rain a year – many undergo extreme temp. changes between day and night – soils rich in nutrients but poor in organic material – animals must be very hardy to handle the extremes



Temperate Woodland and Shrubland

- **Temperate Woodland and Shrubland** – semiarid – hot dry summers with cool moist winters – nutrient poor soil – fires common



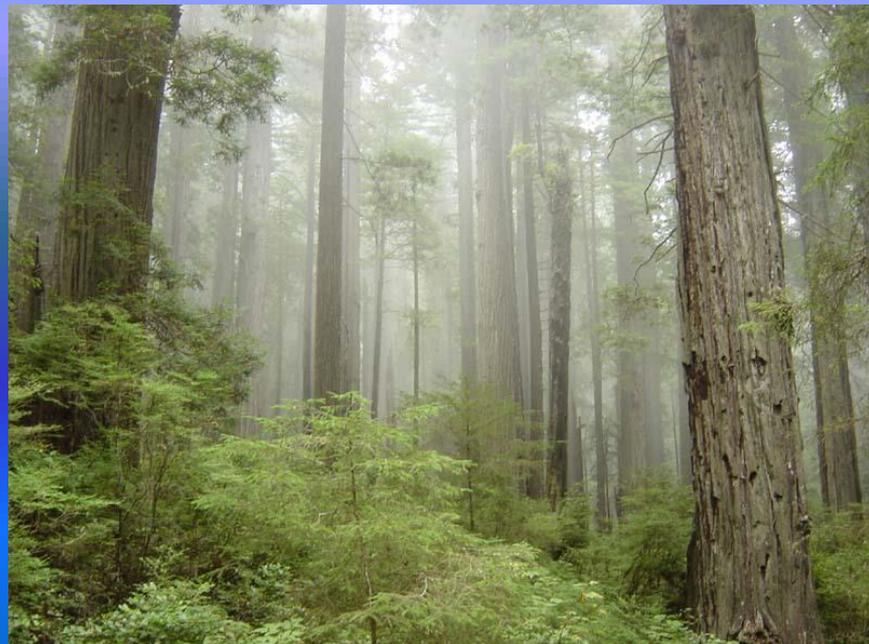
Temperate (Deciduous) Forest

- **Temperate Forest** – deciduous and coniferous trees – cold winters with hot summers – soil rich in humus – year round precipitation (known for change in seasons)



Northwestern Coniferous Forest

- **Northwestern Coniferous Forest** – mild, moist air from Pacific Ocean. Known for conifers and giant redwoods. Found in NW U.S. up through Canada and Alaska. Also known as Temperate rain forest.



Boreal Forest (Taiga)

- **Boreal Forest – taiga** – cold winters, short mild summers – nutrient poor soil – think Canada and Russia



Tundra

- **Tundra – permafrost** is the permanently frozen subsoil – very cold – short cool summers – cold and wind limit plant growth



Mountains and Ice Caps

- Some areas do not fall into any of these biomes. **Mountain Ranges** can have all the biomes in just a few miles. **Polar Ice Caps** can be covered by 5 km of ice with very little life.



Section 4.4 - Aquatic Ecosystems

- Aquatic ecosystems are determined primarily by depth (light), flow, temp, and chemistry of the water (salinity).
- **Freshwater Ecosystems** – have two types: flowing water and standing water ecosystems
- 1) **Flowing water ecosystems** include streams, creeks, and rivers – the turbulent water has high levels of dissolved oxygen, but the water has few nutrients



2) Standing water ecosystems include lakes and ponds – water flows in and out of the system and in the body of water there is a circulation of nutrients, heat, and oxygen

- **Plankton** is the tiny, free-floating organisms that live in freshwater and saltwater environments.
 - these bodies of water have both types of plankton; **phytoplankton** (plants and algae) and **zooplankton** (animals) – these plankton make up the base of the food chain



- **Freshwater Wetlands** – an ecosystem of water covering soil or is present at or near the surface of the soil for at least part of the year – the water may be standing or flowing – serve as breeding grounds for many organisms

- There are 3 types; **bogs**, **marshes**, and **swamps**



- bogs are dominated by moss, found in depressions where water collects

- marshes are found along rivers

- swamps have slowly flowing water and trees and shrubs distinguish them from marshes

Bog



Marsh



Swamp

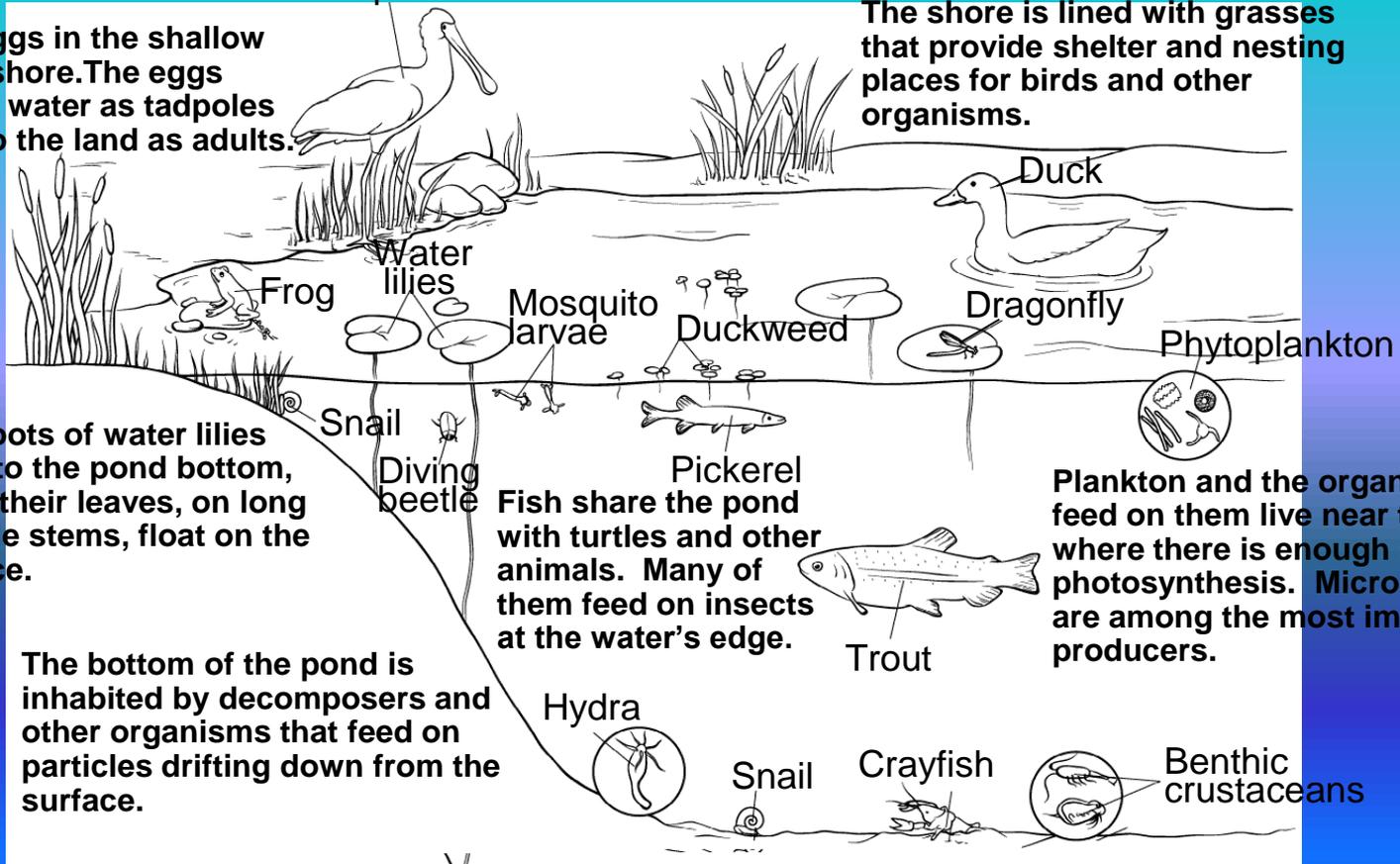


Freshwater Pond Ecosystem

Frogs lay eggs in the shallow water near shore. The eggs hatch in the water as tadpoles and move to the land as adults.

Spoonbill

The shore is lined with grasses that provide shelter and nesting places for birds and other organisms.



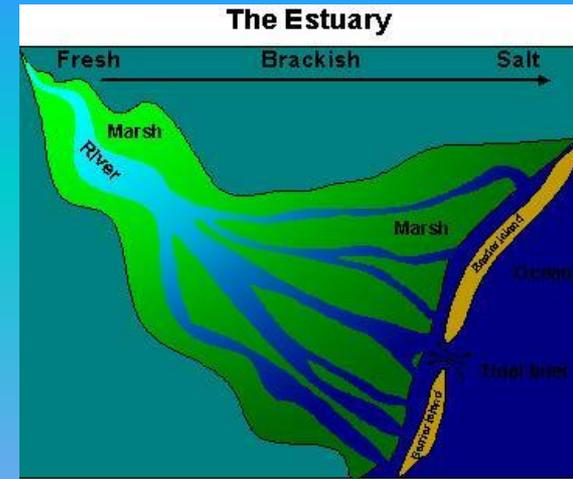
The roots of water lilies cling to the pond bottom, while their leaves, on long flexible stems, float on the surface.

The bottom of the pond is inhabited by decomposers and other organisms that feed on particles drifting down from the surface.

Plankton and the organisms that feed on them live near the surface where there is enough sunlight for photosynthesis. Microscopic algae are among the most important producers.

Estuaries

- **Estuaries** are areas where a river meets the sea and a mix of salt and fresh water is subject to the rise and fall of the tides.
- Producers include plants, algae & bacteria
- Producers usually make detritus.
- Estuaries have lots of biomass and serve as a breeding area.
- Salt marshes: defined by grasses
- Mangrove swamps: coastal areas defined by salt tolerant trees.



Estuary



Salt Marsh

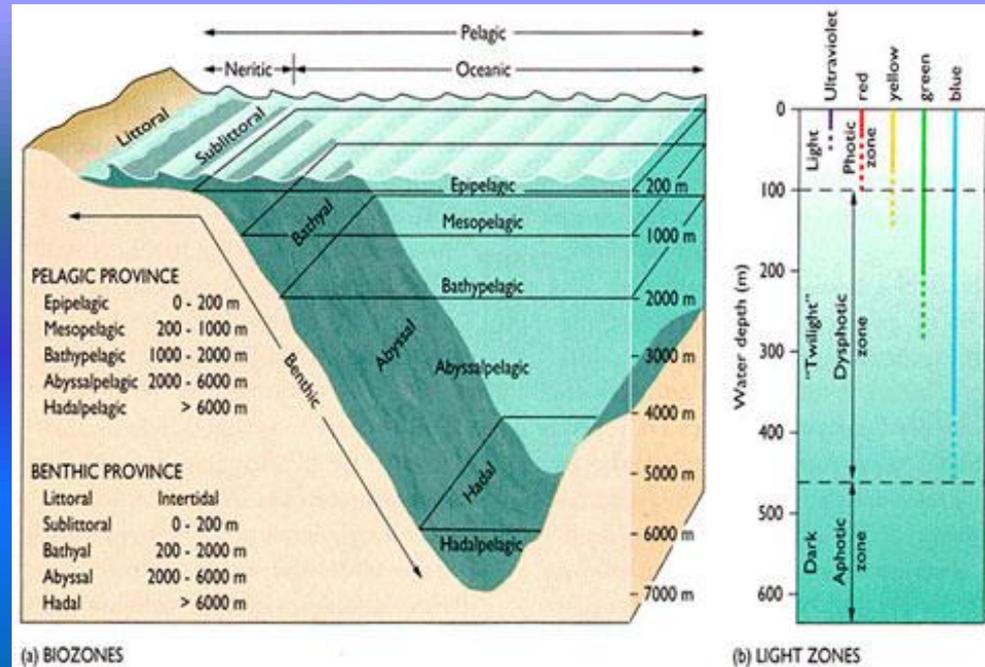
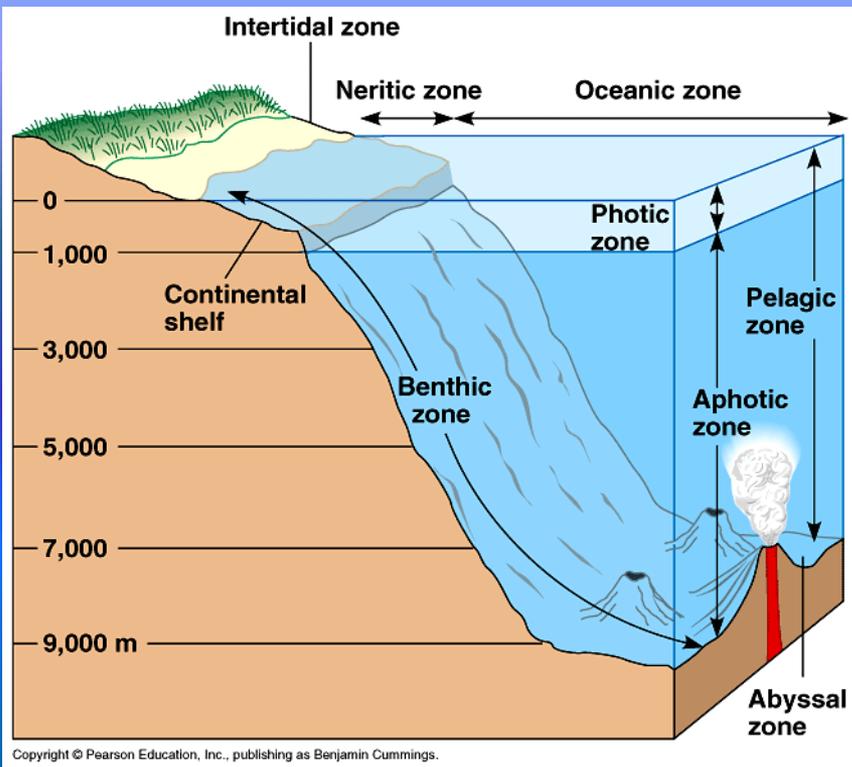


Mangrove Swamp



Marine Ecosystems

- **Marine Ecosystems** – the 2 zones are the **Photic** (light penetrates to about 200m) and the **Aphotic** (no light where the only producers are chemosynthetic autotrophs)



Marine Ecosystems (con't)

- Marine Biologists also divide the ocean into zones based on depth and distance from shore; the intertidal zone, the coastal ocean and open ocean.

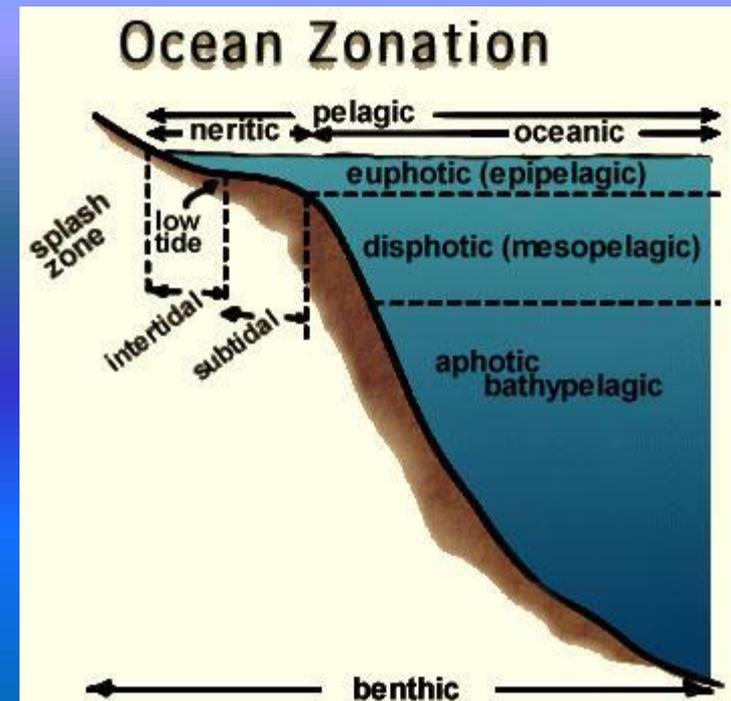
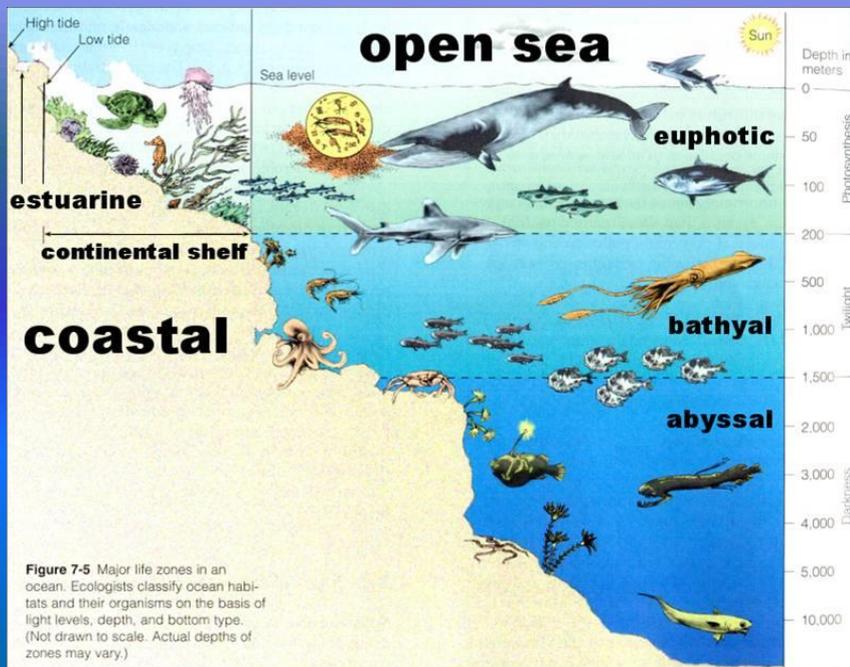
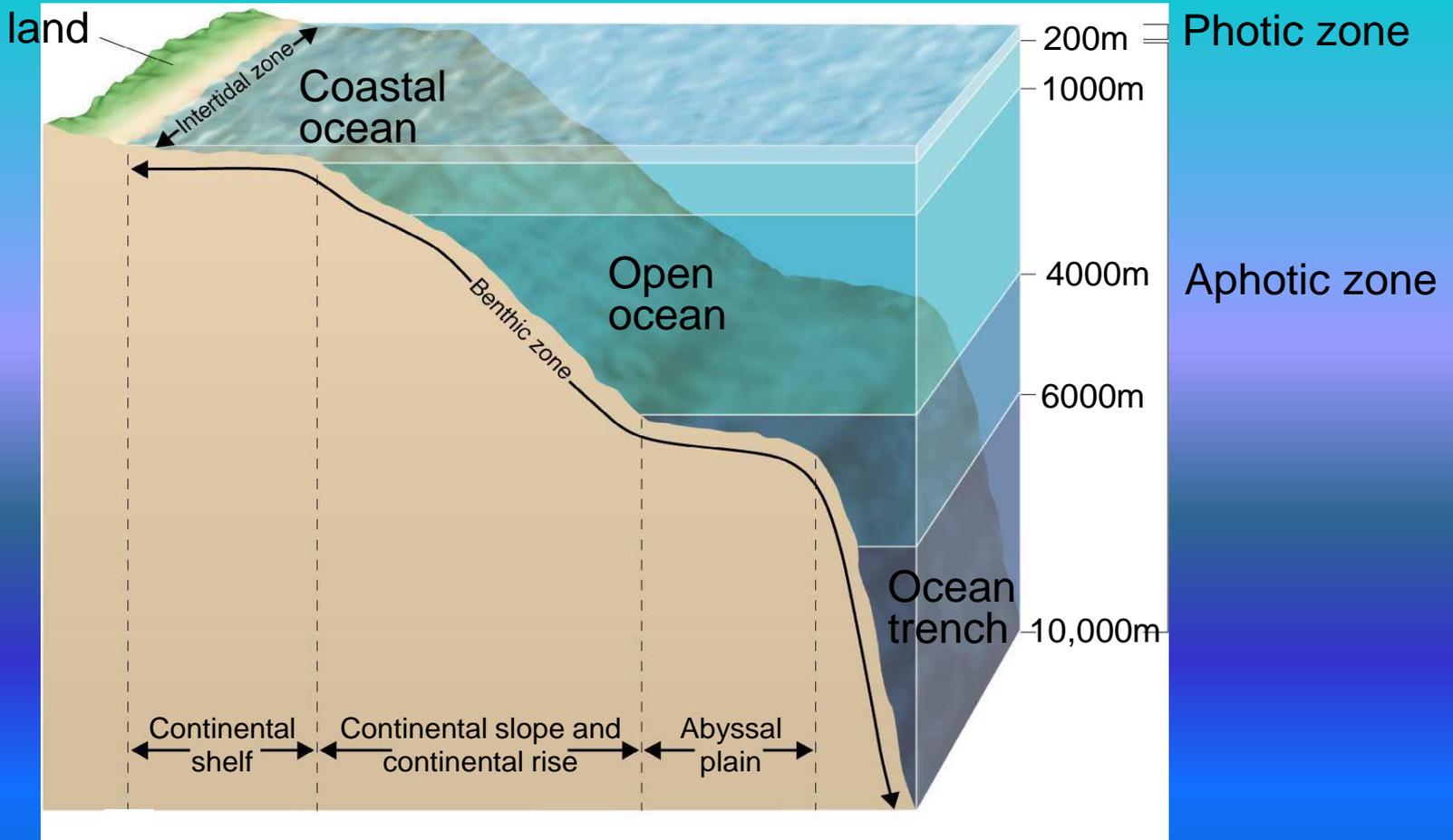


Figure 4-17 Zones of a Marine Ecosystem



Zones of the Ocean

- **Intertidal Zone** – organisms live both above and below the water depending on the tide – competition in this zone leads to **zonation**, which is the horizontal banding of organisms that live in particular habitats.



Zones of the Ocean

- **Coastal Ocean** – extends from low tide to the outer edge of the continental shelf – shallow enough to fall within the photic zone – the kelp forests can be found here.





Zones of the Ocean

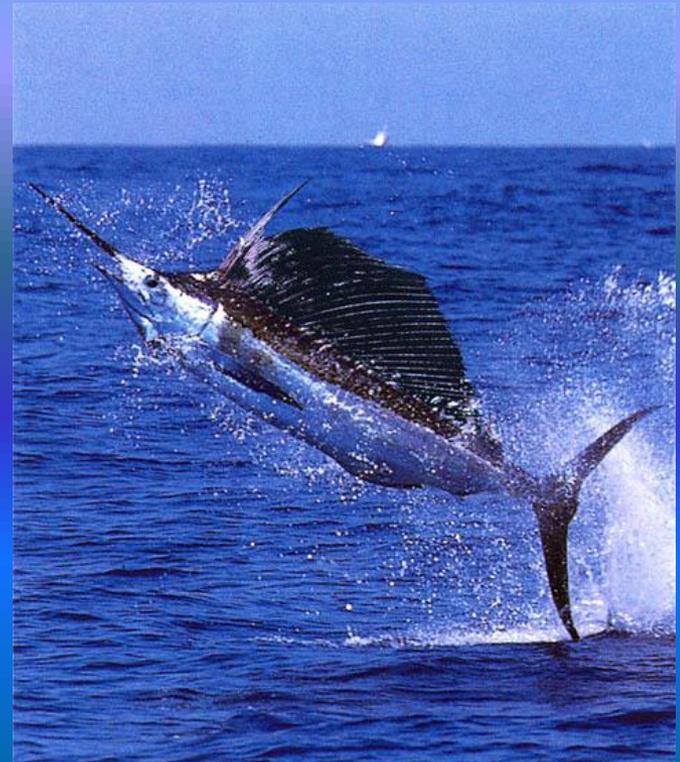


- **Coral Reefs** – in warm shallow coastal waters – the most genetically diverse areas on earth – named after the corals which are tiny animals that produce a calcium carbonate skeleton.



Zones of the Ocean

- **Open Ocean** – makes up more than 90% of the surface area of the world's oceans. Low levels of nutrients and only small producers (plankton). Fishes of all shapes and sizes dominate the open ocean.



Zones of the Ocean

- **Benthic Zone** – The ocean floor contains organisms that live attached to or near the bottom, such as sea stars, anemones, and marine worms. Scientists refer to these organisms as the benthos. This zone extends horizontally along the ocean floor from the coastal ocean through the open ocean.

